LAWRENCE LIVERMORE
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Feb. 21-25, 2011

Hydrogen buses on the move

Ron Cochran, executive officer of LLNL, addresses the audience at the hydrogen technology community outreach event held in downtown Livermore Tuesday. ***Photo by Jacqueline McBride/LLNL***

They are green and white and get 150 miles to the gallon with near zero emissions.

Lawrence Livermore and Sandia laboratories showed off their hydrogen-powered busses earlier this week in downtown Livermore to help educate the public about the benefits of hydrogen fuel.The collaborative effort is part of a strategy for an energy sustainable future and cleaner environment.

Leased from the Ford Motor Company, the buses use internal combustion engines, but are a bridge to vehicles that will use hydrogen fuel cells.

The project is funded by the Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy /Fuel Cell Technologies Program. The DOE is actively engaged in market transformation efforts to demonstrate hydrogen technologies and educate the public about the safety, energy security and environmental advantages of hydrogen as a transportation fuel.

To learn more, see the video.

Junk yard in space

A visualization shows the simulated debris from an exploded satellite in the lower Earth orbit along with active satellites positioned using a semi-analytical orbital propagator. ***Illustration by Ming Jiang/LLNL***

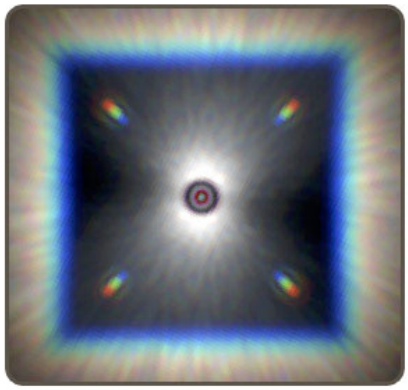
When a U.S. communication satellite crashed into a Russian military satellite in 2009, Laboratory scientists got to work on tracking how such a collision could happen and how often something similar could go awry.

With more than 200,000 objects orbiting the Earth and only a few hundred satellites tracked, Laboratory space scientist John Henderson uses some of the Lab's largest supercomputers to predict that such a collision is likely to happen every two years.

He said the Lab's supercomputers and algorithms can predict such collisions in minutes. Working with Texas A&M, Lab scientists will soon launch pathfinder satellites to act as a traffic camera in space that can generate warnings when a collision is likely to happen.

To learn more, see the video.

Look in the mirror and see a planet



Simulated short-exposure, adaptive-optics- (AO-) compensated image. The square dark region is where the Gemini Planet Imager's (GPI's) high-order AO system produces excellent wavefront correction of the atmosphere and enables high-contrast imaging. ***Image courtesy of Marshall Perrin, Space Telescope Science Institute***

In the last 20 years, the optical telescope has revealed not only that planets exist around other stars, but also that these exoplanets are relatively common and come in an astonishing range of sizes and orbits.

But if we could directly image an exoplanet and study the spectrum of the light from it, we could know what that planet is made of, its surface temperature, the strength of its gravity and, potentially, if the planet harbors life. And scientists like the Lab's Lisa Poyneer are on their way to doing this.

Directly imaging an exoplanet is extremely hard because planetary light-reflection and -emission is typically at least a million times fainter (and may be more than a billion times fainter) than the host star. Only very recently have astronomers been able to directly image exoplanets using adaptive-optics (AO) technology, applied to large (8–10m diameter) telescopes, which can reduce the deleterious effects of the atmosphere and make direct imaging of exoplanets possible.

A key component of an AO system is a multifaceted, deformable mirror (DM), the shape of which is adjustable, so that it can compensate for the atmospherically distorted light it collects.

To read more, go to the Web.

Lab jets tackle cosmic blasts

Physicist Hui Chen sets up targets for the anti-matter experiment at the Jupiter laser facility. ***Photo by Jacqueline McBride.***

Lab experiments that collide two jets of positron-electron pairs may help physicists identify the source of gamma-ray bursts in distant galaxies.

Researchers detect these intense flashes of light about once a day, but no one knows their source.

The Laboratory's Hui Chen has conducted a series of experiments where she and her colleagues created and controlled jets of electrons and their antiparticles (also known as positrons) in the Lab.

Chen's next experiment will wack them into each other. The collision is expected to create a shockwave that will accelerate particles to high energies and emit radiation. If the signal resembles that seen in space, it may point to a culprit.

To read more, go to the Web.

Mono Lake's very own Loch Ness monster

Mono Lake research area

In the depths of California's Mono Lake lives a tiny bacterium called "Strain GFAJ-1" that grows and reproduces using arsenic, the element that triggers death to most Earthly life forms.

A team of scientists from the Laboratory, the U.S. Geological Survey, Arizona State University, Duquesne University and Stanford University determined that the finding is the first known living organism that can use arsenic in place of phosphorus in its major macromolecules. The discovery could redefine origins of life research and alter the way we describe life as we know it.

Oxygen, carbon, hydrogen, nitrogen, sulfur and phosphorous are the six basic building blocks of life on Earth. These elements make up nucleic acids, proteins and lipids -- the bulk of living matter.

But the new study found that a bacterium isolated from Mono Lake may substitute arsenic for phosphorus to sustain its growth.

To read more, go to the Web.
